P R O T E C

REWIND 2006

Swedish submarine in America

Archer Artillery System

Eurofighter chose FMV

Encryption for the future

SELECTED ARTICLES FROM PROTEC MAGAZINE.ISSUE FOR 200

International cooperation – a central issue for FMV

FMV is an authority that develops and purchases materiel with high-technological content. From an historical perspective we have developed a lot of things ”on our own,” but our work will now, to a larger extent, involve creating knowledge about the materiel that is available on the market and purchasing and modifying that materiel. If the materiel is not available on the market we will investigate the possibility of developing the materiel with other countries. Only as a last resort will we develop materiel solely for the needs of Sweden. Nationally developed materiel shall, however, be possible to export. Special solutions solely adapted to Sweden are no longer of immediate importance. In this way we can achieve cost efficiency at the same time that our Swedish units can participate in international military efforts.

Our external magazine, PROTEC, has enabled Swedish readers to share in some of our 2005 assignments – large and small, national and international, with the common denominator that they all deal with technology for Sweden's security. In PROTEC REWIND we present a selection of articles from 2005.

Gunnar Holmgren
Director General

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What is FMV?

FMV has a clear and inspirational assignment: to be responsible for the supply of materiel to the Swedish defence organisation.

The challenge FMV faces is to find, propose and introduce innovative and cost-effective solutions to safeguard the development of the defence organisation, in relation to both technology and new equipment.

Developments taking place in the total defence system present many great, complex and exciting opportunities. Military defence has to be developed to operate in a network-based manner and in collaboration with international forces, while civilian defence has to cope with severe and unforeseen strains on society. As an independent, civilian authority, FMV contributes both knowledge and a high level of expertise in many different areas.

FMV has around 1.800 employees, mainly located in Stockholm, Linköping, Karlsborg, Vidsel and Arboga. Invoiced sales amount to around 20 billion Swedish crowns every year.

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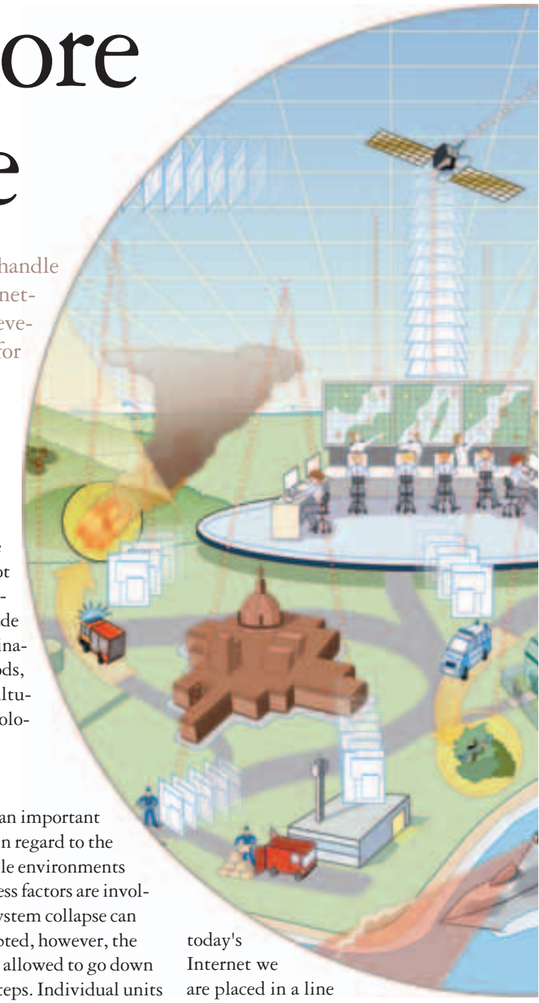
Cover picture
Archer Artillery-system. Photo: Bofors

Network for more flexible defence

Sweden's future military efforts are based on a number of networks that will handle large amounts of information with extreme flexibility, speed and security; a network that meets these requirements does not exist today, it will have to be developed. Right now, operations are working towards formulating regulations for how the network-based defence management system shall be constructed.



The remnants from the cold war are now being swept out of the Swedish Armed Forces. Now, the goal is to establish military efforts that can meet new and partially unknown threats. In order to reach this goal we must utilize the rapid development within the civil IT-area. The majority of operations today are digitalised, but often with methods and interfaces that are not standardized, which makes cooperation complicated. New hardware and software is required in order to achieve this goal. If the number of cooperative partners increases, complexity will also increase exponentially.

The number of players in the Swedish Armed Forces is extremely large. Complexity in the new defence forces cannot be underestimated. For example, every soldier may need a number of individual IP-addresses. Then, if the Swedish Armed Forces are able to cooperate nationally, for example with police and fire departments, etc., municipalities and county councils, as well as internationally with the units of other countries, it is easy to realize that standardization is a key work in a network-based management system.

Tough demands

The military network is facing a long series of challenging demands where solutions can sometimes be found in civil developments and sometimes not. In certain cases, solutions are required that have not been invented yet. These solutions ”away from the cutting edge of technology” must also be considered in Sweden's decision to convert to a network-based defence system.

Possibly the most difficult and most important requirement area is security. The Swedish Armed Forces must be able to trust that sensitive information will not fall into the wrong hands. At the same time, this information must be made available to the people who need it.

Mobility is another key word. The network-based management system must allow the involved units to move freely over ground areas, in buildings, under the water and in the air and remain connected to the network at all times.

Cooperation

Demands on a network-based management system are stringent. Planned cooperation shall be able to occur between various players on both a national and international level and also where NATO standards apply. Spontaneous cooperation shall be able to occur between all friendly forces that can have a positive effect on the course of events. The complexity that will result from this demand cannot be overestimated. How can you be sure that they are actually friendly forces? Is the same language spoken? Are there the same references? Encryptions? Frequencies? Methods? Rules of Engagement?

Today, nearly every country has purchased its own unique solutions. However, the problem is not purely technical, but is made up of a combination of methods, languages, cultures and technologies.

Reliability

Reliability is an important requirement in regard to the fact that hostile environments and major stress factors are involved. A total system collapse can never be accepted, however, the system can be allowed to go down a number of steps. Individual units must be able to act autonomously, in other words without constant contact with the joint network. Synchronization must then be made automatically at the next contact.

Incredible amounts of information will be handled in the system. Therefore, people need help from decision-making support functions that can adapt and structure the information according to the needs of different users. Among other things higher Man-System-Integration competence needs to be developed in order to optimize the technical systems according to people's needs and abilities, but also to select and further develop those people that are involved. In today's Internet we are placed in a line when there is an overload. In a military effort for Sweden's security that is unacceptable. Therefore, the system must have functions such as dynamic prioritisation and preferential rights despite the fact that you do not know what the status is from time to time.

Parts of the software and hardware in the system shall also be able to be replaced, taken away or added without the system having to shut down. Open, civil solutions are primarily chosen to create the possibilities for wide competition.

Producer & consumer

Today, development work is progressing well, but already a

number of concepts have taken hold. All operations are described as services. Players produce and/or consume services. Services are published on the network and become available for those who have authorization. The basic value is that everyone should have access. What the services look like is sometimes determined in a contract between the producer and the consumer, but often by a third party. Who gets to use the services is determined by a fourth party, with today's thinking, an "executive", with tomorrow's thinking, wide open for good ideas.

All players are either producers or consumers or a combination of the two. For example, a soldier in the future defence forces can produce information about his surroundings with the help of his helmet camera at the same time that he/she is the consumer of a service that describes the tactical status in the immediate area.

Creating temporary combined forces can occur with the help of special software. The person who is given authorization can thereby create an ordered cooperation between units. The default value is the unit organization and many alternate fighting groups can be prepared. Setting up new constellations must occur rapidly.

Adapted information

In consideration of the infinite amount of information that players have access to over the network, the system must automatically sift out the current information that is to go to every player. The system must also present the information in a way that is adapted to the specific player.

This involves a great number of challenges in regard to immediate interest, reliability, geographic adaptation, identity and also adaptation to role and competence.

Technology's cutting edge

In view of the fact that a network-based defence system has never seen the light of day, the Swedish Armed Forces have chosen to create a development project that is allowed to take a step forward. The idea is to get the possibility to test many different solutions and ideas, all of which do not necessarily have to function. Technology, methods, organisation and personal development will be handled parallel through close cooperation. FMV, which has been entrusted with the technical aspects, has made connections with an industrial consortium consisting of four major players within the management systems area. Together, Ericsson, Saab, Boeing and IBM have both civil and military experience and competence. The four corporate giants all realize that the assignment to develop a network-based management system is so interesting and important that they want to participate despite the fact that Sweden is a small country with limited development resources. Ericsson and Saab have formed a development company – NBD Innovation AB – which in turn has contracted Boeing and IBM.

Enköping

To get a joint, adapted development environment, the Swedish Armed Forces' Centre for Management System Development has been established in Enköping, outside Stockholm. Simultaneously, a demonstration IP-network has been established independently from other, stronger networks. With high capacity, the network can connect different test sites prior to scheduled tests and trials.

The operation in Enköping can simply be described as a number of tests, trials and demonstrations with and without actual units where hypotheses are tested and evaluated. Each spring and fall personnel are called in from the "field" for test weeks at the development centre. That is when ideas are tested with the help of experienced "laymen," who hopefully are unaffected by the enthusiasm and development optimism that the project workers are sometimes seduced by. What works? What doesn't? What can be improved and what needs to be further developed? The viewpoints and experiences of the participants are evaluated thoroughly and form the basis for continued development.

Currently, there are plans for the development work to be carried out until the New Year 2006. After that, FMV will propose design regulations and documentation to begin design of an active system for a network-based management system that should be operational in 2010. After that, development will continue infinitely. A network-based defence is never completely finished. New services and functions are introduced and updates are made constantly – all while the system is online.

In the network-based defence, the Swedish Armed Forces will be able to cooperate with police and fire departments, etc., municipalities and county councils, as well as internationally with units from other countries.

The road so far

In 2002, FMV was assigned by the Swedish Armed Forces to formulate regulations for how a military network, which shall form the basis for more flexible military efforts, could be constructed. FMV is carrying out the work in a project called, LedsystT. The Swedish Armed Forces are taking care of the methodology, organization and competence development in parallel organisations: LedsystM, LedsystO and LedsystP, respectively. In addition, the Swedish Defence Research Agency, FOI, is supporting work across a broad front. In order to achieve a functioning network for the armed forces a small embryo of the final system has been created. This system goes by the name of "service demonstrator" and consists of a number of connected computers and systems. This includes a mix of new, untried technology as well as existing systems such as the radar system (UndE 23, Sea radar and PS890) and the management systems (Strics and SLB). New technology is partly represented by components that were previously developed in connection with defence, for example, MST (Multi Sensor Tracker) and the fusion node, WASP (Wide Area Situation Picture), and partly by commercial products for kart engines, MMI components and systems that provide these in the network.

Every system in the service demonstrator produces different kinds of information (called services). In the demonstrator, dynamic combinations of these services are then created so that the operator, in the best way possible, can get support in his/her specific management task. Every service can be saved and published so that it will be available from optional operator locations in the current network.

The service demonstrator is being continuously developed. For each version the design is documented in the form of independent implementation service specifications and goal architecture on a comprehensive level as well as for every system that is included.

The service demonstrator provides an image of the future work. A defence system that is supported by a network-based management system provides the desired characteristics for flexibility, dynamics and accessibility but also results in new challenges and questions. How and who shall administer and decide on what service configurations there shall be and who gets access to what? How are resource conflicts resolved? The service demonstrator is the tool that is needed in order to work further with these central questions.

As a link in the development, design, realization and demonstration of different versions of the service demonstrator have been carried out every spring and fall since 2003.

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ILLUSTRATION: LEIF ÅBJÖRNSSON

IN-FLIGHT REFUELLING

In November 2005 the first in-flight refuelling of the Gripen aircraft was done from the Swedish Air Force's transport plane, the C-130 Hercules.

The test flights in November 2005 were the first in a series of in-flight refuelling that FMV has carried out together with Saab.

"The flights were carried out according to plan and all goals were achieved. During the course of the program, we have investigated the capacity to carry out refuelling between Gripen and refuelling aircraft, including refuelling at different speeds, altitudes and with different cargos. FMV is now continuing with additional test flights," says Jan-Olof Lindström, test pilot at FMV's test site in Linköping.

FMV initiated the project, "TP84 Tanker," in 2000 and the goal is that a certified in-flight refuelling demonstrator for the Swedish Air Force's C-130 Hercules transport aircraft will be operative as of January 2006.

The Hercules plane is part of the F 7 wing at Såtenäs and is equipped with the latest generation of refuelling technology, including a totally electric capsule. Two extra fuel tanks will be added to the system in the spring of 2006.

In April 2005, Gripen's in-flight refuelling ability was verified by a NATO-adapted refuelling aircraft from the South African Air Force.

C and D versions of Gripen are completely NATO-adapted and meet the requirements for both national and international missions. The in-flight refuelling ability increases Gripen's operative breadth and sustainability, which give major advantages in international missions.

COPY: ULF LINDSTRÖM
PHOTO: RICHARD LJUNGBERG

Two Gripen aircraft on the way to the Czech Republic airbase, Caslav.

GRIPEN ON SITE IN THE CZECH REPUBLIC

On June 14, 2004, FMV entered into a contract with the Czech Ministry of Defence regarding the leasing of 14 Gripen aircraft. Since August 2005, the planes have been on site in the Czech Republic.

In April and August of 2005, the Czech Republic's Gripen aircraft were delivered. The 14 aircraft are of the latest C and D versions, which means that they are fully NATO-adapted.

"From the Swedish side, naturally it feels really good that with this delivery we have shown that we have been able to adhere to the very tight timeframe that applied to the delivery to the Czech Republic. This has been accomplished through committed and goal-oriented work by FMV, the Swedish Armed Forces and Saab," says Per Nilsson, project manager for the Czech Republic program at FMV.

The leasing agreement, which FMV signed with its Czech counterpart in June 2004 means that the Czech Republic, over the next 10 years (2005-2015), will lease 12 single-seat and two two-seat Gripen aircraft.

Training

Parallel with the production of the aircraft, Czech pilots and technicians have undergone training on Gripen in Sweden since August 2004. As a part of the leasing contract, Sweden will have Swedish pilots and technicians on-site in the Czech Republic during the leasing period to act as advisors for the Czech Air Force.

In addition to the Czech Republic, Gripen has also been exported to Hungary and South Africa. Hungary will lease 14 aircraft between 2006 and 2016, after which the planes will then become the property of Hungary. The aircraft will be delivered in 2006 and 2007 with an initial delivery in March 2006.

South Africa

South Africa has also fallen for the cost-efficient, high-performance, multi-role combat aircraft, Gripen. In October 2003, Saab began production of South Africa's Gripen aircraft. In March 2008, the first delivery will be made.

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PHOTO: PIA ERICSON

PROTEC REWIND

Beware the articulated hauler

Swedish artillery is moving towards regeneration. A dumper constitutes a cornerstone in the system.

The Air Force deserves plenty of credit, but an artillery system is required in order to defend Sweden during bad weather conditions. The Swedish artillery has always maintained a high level of technology. Today however, a part of the artillery system is becoming outdated. Therefore, several projects are underway to create a future artillery system and upgrade the entire function of indirect fire. Improving a sub-system is not enough. A chain is only as strong as its weakest link.

One of the most interesting projects within the area is one whose purpose is to replace the old 155-millimeter Haubits pieces, 77A and 77B, with a Haubits vehicle. With the new system, range will be substantially increased. In combination with new ammunition, targets can be precision-targeted at a distance of up to 60 kilometres.

"The system is based on the old Haubits, 77B, and a dumper chassis from Volvo," says FMV's project manager Jan Nee.

Archer

The new artillery system is called the Archer Artillery-system 08 and will give gunners a big step forward.

"With the old 77B, the gun had to be more or less permanently positioned," says Jan. "It takes ten minutes to dismantle the system and move to another position. With Archer it will take no more than 30 seconds to stop and be ready to fire. In another 30 seconds you can fire off 6 rounds. During the next 30 seconds you can pack everything and after another 30 seconds you can be 500 meters away."

With the future ammunition rounds, Excalibur and Bonus, Archer will be able to execute precision fire on its target. This means that soldiers can fire on a single building instead of firing against a larger area.

The workplaces in the cabin provide the operators with full control over the system. A computer system assists with everything that is needed. Via computer screens the operator can guide and fire both the cannon and the roof-mounted machine gun. Through the computer, verbal and written communication is handled as well as calculations and information regarding supreme command, navigation, ballistics, security, ammunition handling and operational follow-up.

Safety

The environment and safety around the system is also a major

Archer's excellent firing performance and short regrouping time provides effective fighting technology since the target can be fired upon immediately after the order to fire is given. With modern ammunition the system has the possibility to attack armoured targets and also the ability to utilize precision fire from a distance of up to 60 kilometres.

step forward. In the old pieces the operator was completed unprotected. When firing, the operator's hearing and inner organs were exposed to very strong sound and pressure stress. In the event of counter fire soldiers were also exposed to splinter fragmentation. With Archer these types of risks do not exist. The cabin is protected against sound, splinter fragmentation and mines. It is also airtight and resistant to NBC-conventional weapons.

"To hold down the vehicle's weight and production costs we have concentrated on protecting the personnel areas. On other parts of the Archer piece we have added protection according to needs," says Jan. "In that way we have lowered the total vehicle weight to 30 tons. That gives us good possibilities to pass over rickety bridges, for example, like those in Kosovo.

Dumper

The Archer Artillery system 08 is based on a Volvo dumper model A30D. The frame and driving rope have been retained in their original condition. The transmission has been altered to provide the vehicle with a top speed of 70 km/h. By retaining the engine as it is, Volvo's environmental certification is maintained.

In addition, the cab has been replaced by a mine and splinter fragmentation protected variant, but inside, Volvo's original instrument panel is intact.

"We are quite thorough about maintaining a strict interface between Volvos's original parts and the equipment we add or alter," says Jan. "We are utilizing as much of the original features as possible. That is why we try to get new equipment that fits in the existing spaces in the chassis, etc."

There is more above the frame than just the cannon. There is also a magazine for loading grenades and a storage area for extra ammunition.

Longer range of fire

Archer utilizes barrels similar to the artillery piece 77B, but it has been extended by two meters and now measures a little over eight meters. This gives the system a longer range of fire.

Aside from the barrel, there are not that many other similarities between the two weapon systems. One of the main differences is that Archer will have a rapid, automatic loading system. Short loading times and quick readjustment of the firing angle means that the Archer piece will be able to fire two grenades at the same target within ten seconds, provided that the magazine is prepared with the right amount of gunpowder for each shot. The old 77B can fire only two grenades within this time interval.

The already existing ammunition will, in addition, get a longer range of fire with the new system," says Jan. This is due to the extended barrel, but also because of newly developed gunpowder and a larger powder chamber.

It is clear that the Archer system will be cost-efficient. Utilization of the civilian parts is unusually large and the light weight provides more freedom in regard to the logistics of the vehicle. In comparison to many tracked artillery pieces, Archer is light enough to be transported by aircraft.

Studies

The concept study for Archer was initiated in the autumn of 2001 and since then there have been a large number of details and solution proposals to study. How do you achieve the best possible protection in combination with low weight and a low profile? How will the firing power from the cannon be transferred down into the ground? How should the magazine be designed in order to handle automatic loading? These questions and many more have been discussed and sketched even down to the gearwheel level.

"It has been stimulating," says Jan. "Thanks to a close cooperation with the Swedish Armed Forces we have developed an artillery system for the next decade."

The fact that this is a prominent project has been proven by the interest from the Danish defence forces. They have followed the work since the summer of 2004 and plan to enter into the project on a 50/50-basis. Jan is very happy that FMV will be allowed to further develop the system in cooperation with the Danes.

"With today's defence budgets, it is important to split development costs with other countries," he states.

Demonstrator

In January 2004, FMV ordered a viability study from Bofors Defence. This involves the company building two functioning demonstration vehicles. The first of these was delivered in August 2005 and the second will be delivered in March 2006. Over a two-year period these two vehicles will be evaluated by the Swedish artillery regiment in Kristinehamn/Boden as well as by the Danish artillery. The tests will be carried out under actual conditions together with other artillery systems. Experiences from these exercises will form the basis for the subsequent product definition phase. The mass-produced vehicles will then be delivered to the Swedish Armed Forces beginning in 2008. Between twelve and 50 Archer-units will be purchased. The exact number will be determined at a later date and depends on the current need in relation to the final cost. The Swedish Armed Forces intends to establish two Archer battalions, ready for deployment in 2010.

Service vehicles

Archer will be able to transport 20 rounds, but can fire as many as 432 rounds in a 24-hour period. Therefore, the Archer series will also have a number of ammunition and service vehicles based on the same type of dumper as Archer.

When the Volvo dumper has undergone its full transformation to an Archer unit, the cabin will have been modified beyond recognition, somewhat like the photo above.

”In total, the new system is substantially more competent than the old one,” states Jan. One Archer will be able to replace a number of 77Bs, especially in regard to manning the piece. The new system actually only needs one driver and one operator, while the old system requires at least five persons, but which in reality is often manned by ten to twelve persons. It is likely that there will be three to four soldiers assigned to each Archer.

Today, the Swedish Armed Forces has 50 Haubits 77Bs. The even older piece, the 77A, was phased out during 2005. How long the 77B remains a part of the Swedish Armed Forces depends on how many Archers are ordered.

COPY: JERRY LINDBERGH
PHOTO: BOFORS & FMV

ARTILLERY TODAY

The Archer concept is a further development of the Bofors manufactured artillery piece, Haubits 77B. The older piece’s upper gun carriage has now been mounted on a heavy terrain chassis (dumper) from Volvo. In addition, the piece has been upgraded for better firing performance and increased compatibility with international ammunition. It has also been equipped with the necessary equipment to enable it to be fully remotely served via the system’s computer.

FMV is currently working with a number of projects within the function, ”indirect fire,” in other words, attacking a target that is outside visual range of the system. The artillery shall be more splinter fragmentation protective and the cannons will be able to obtain a longer range of fire. However, the most important aspect is that the artillery will be more mobile. Today, this involves being able to rapidly follow along with those troops that the unit is supporting. There isn’t always time for preparations. The new system was therefore developed with mobility as the foremost requirement.

Before, it was about attacking a certain land area. Today there is a possibility to obtain such good information that you can directly hit a point target, for example a window in a building, which is 60 kilometres away. To achieve effective artillery it is not enough to have a number of flexible and long-range Archers. Complementary systems are also needed, both in regard to weapons and information retrieval. These may include the artillery localization radars, Arthur and EOI, the new fire direction instruments for commandos. These systems provide the Archer system with information about where the targets are located.

The new ammunitions, Bonus and Excalibur, will give the artillery extra long-range firepower, and the firing platform system, Splinter Fragmentation protection grenade launcher 120, will be a good complement to Archer’s firing ability.

Another important aspect in the effectiveness of Swedish artillery is that they are now converting to the NATO standard to the extent that this is possible. These standards involve firing methods for artillery and the calculation of ballistics.

By using NATO’s standards instead of developing their own, the Swedish Armed Forces will become more inter-operable with the armed forces and materiel from other countries.

Jerry Lindbergh

PARTICIPATION AS A GUIDING

STAR EUROPEAN DEFENCE AGENCY

Europe is aiming for the future.
With a joint defence agency, development around crisis management, research and defence materiel development is being strengthened.

Herman Jentzen and Niklas Alm are positive about Sweden's future in the European Defence Agency.

The joint European defence agency, EDA (European Defence Agency), has existed on paper for some time. Since July 12, 2004 it has also existed in reality.

“The need to bolster Europe’s military capabilities to match our aspirations is more urgent than ever. And so, too, is the need for us to respond better to the challenges facing our defence industries. This Agency can make a huge difference,” says Javier Solana, high representative and head of European Defence Agency.

24 countries

All EU countries except Denmark are members of EDA. That makes a total of 24 countries. Thanks to its prominent defence industry and long-range defence research, Sweden is viewed as one of the strongest countries within EDA. This means that Sweden has an actual possibility to influence the operation. But that also places demands on Sweden to show active involvement. If the cards are played right, EDA can be a major opportunity for Swedish materiel purchasing, and especially for the Swedish defence industry.

”International cooperation offers enormous opportunities, but we Swedes have to become better at putting our best foot forward and influencing development,” says FMV’s Niklas Alm.

Niklas works with supporting the Swedish Cabinet office and the Ministries with the introduction of new procedures and working methods so that Sweden will be able to act more effectively within EDA.

”One of the largest difficulties we face is finding suitable working forms between FMV, the Swedish Defence Research Agency, the Swedish Armed Forces and the Cabinet Office and Ministries,” says Niklas. We need to work in some sort of joint group, but simultaneously the issues must be originated in each individual organisation.

Research

As of yet, no projects are being carried out within EDA. As early as 2006, however, it is planned that a number of earlier European cooperative projects will be transferred to EDA. This concerns pure research projects. Handling issues regarding joint materiel purchasing is not yet of vital importance.

”In the initial stage, EDA will most likely not be engaged in major, joint purchasing projects. Instead, the focus will be on finding benefits in, for example, joint technologies, standards and maintenance concepts. However, over the long-term, EDA will be developed into becoming an important united resource and catalyst where different countries will cooperate with purchasing,” say FMV’s Deputy Director General, Jan-Olof Lind, who in the role of National Armaments Director (NAD), is a member of the board of EDA.

Start-up phase

Today, a great deal of work is being carried out within EDA in order to find detailed forms for the agency’s continued development. There are many practical challenges. Structures have to be refined and that especially means finding the right personnel competence for the various work tasks within the agency.

”EDA is still in a start-up phase, but the organization has strong political driving forces so that in time it will become increasingly important,” states Herman Jentzen, who together with Niklas Alm is one of the major players in FMV’s work regarding EDA-issues.

Choices

In new projects, FMV has to, exactly like other countries’ materiel providing authorities, ask the question of how each project can be managed in the most effective way. Should it be run nationally or through some sort of cooperative effort? The choice depends on the economic framework and confidentiality levels. Membership in EDA does not mean that you are forced to carry out your project on the EDA-track, but it is clear that Sweden’s future materiel provision will, to a substantially larger extent, be connected to international cooperation.

COPY: JERRY LINDBERGH
PHOTO: JERRY LINDBERGH

EDA

The European Defence Agency was formed on July 12, 2004 and is an EU-authority for the cooperation of European research projects within defence materiel provision. The EDA is led by the European Council General Secretary, Javier Solana. The board consists of five representatives from each of the 24 member states (all EU-countries except Denmark). The board is combined in four different formats – defence minister, defence materiel directors (National Armaments Director, NAD), research directors and also representatives for benefits administration. Each group meets twice annually. The four Swedish representatives are Defence Minister Leni Björklund, FMV Deputy Director General, Jan-Olof Lind (NAD), Director General Madelene Sandström, the Swedish Defence Research Agency, and Lieutenant General Mats Nilsson, Swedish Armed Forces.

EDA has four primary tasks:

*To develop defence abilities in regard to crisis management.

*To promote and improve European materiel cooperation.

*To strengthen the industrial and technological defence base and also to create an internationally competitive defence materiel market.

*To improve efficiency in European research and technological development cooperation.

Currently the EDA has a budget of 20 million Euro. A major part of this has been allocated for study and research assignments.

Encryption for the future

Encryption device 920.

Sweden's future, network-based defence is getting closer. A new advanced encryption system will be one of the fundamentals for secure information flow.

Today, the Internet is one of the cornerstones in our civilian society. The Internet affects how we communicate, do business and obtain information.

In the future, military operations will also be increasingly based around networks. The decision-making cycles will become shorter and critical assignment information can be rapidly distributed to the right recipient. But in order for this future defence organisation to become a reality, a series of security questions need to be solved. The challenge lies in creating security that does not restrict the growth and usage of the network. That is where encryption comes into the picture.

On behalf of the Swedish Armed Forces, FMV has been working for several years with developing specifications for a new IP-based encryption system. With the encryption device 920, the new demands for speed, performance and functionality will be met, regardless of whether it applies to computer, video or voice communication.

Chief of Staff for the Swedish regiment, P7 Revingehed, Jörgen Forsberg, is participating in testing the new IP-encryption system.

Synergy

In May 2002, FMV issued an invitation to submit a tender offer to the industry. Of six tenders, the company, Business Security, met the demands at the lowest price.

"Parallel with the Swedish Armed Force's new encryption system the company is also developing a commercial variant of the system, aimed at larger international companies with very high demands on security, for example, within the pharmaceutical or financial sectors. In this way, the costs for FMV and the Swedish Armed Forces are kept low," says FMV's project manager, Tommy Lydh. But of course, only a part of what is developed for the military can be used commercially.

One of the challenges in the project is to be able to coordinate the high security demands with the demands for a functional, adaptable product. The encryption device 920, is based on the absolute latest IP-technology and meets military demands for ensuring integrity, confidentiality and authenticity. The system is based on real-time solutions designed to securely deliver assignment critical information throughout the entire chain of command – whenever and wherever. Consequently the system supports satellite communication, which is necessary to quickly establish secure contacts in inaccessible areas. Encryption of videoconferences and IP-telephony is also supported. Other features include an advanced key management system that is specially adapted for IP-encryption.

"In addition, the system is modular. It is important that we can offer the defence forces and other authorities a flexible security solution that works for future communication solutions," says FMV's Kjell Albiin, product manager for IT-security systems.

Test period

After a period of work with functional models, ten prototypes were delivered to FMV in the summer of 2005.

"The prototypes are now being fully tested in the laboratory environments," says Tommy Lydh.

During the spring of 2006 the prototypes will be passed on to users in the Swedish Armed Forces and other authorities, so that final users can try to build a network with them in an actual environment. In the case of the Swedish Armed Forces, it is thought that the encryption attempt will be made down to the unit level.

During the second half of 2006 the first of a total of 350 new encryption devices will be delivered, and before July the delivery will be completed. Up to now, things have gone according to the established time plans.

"The work has gone extremely well," states Business Security's development manager, Roger Eriksson. "Our work with adhering to time schedules, costs and quality has gotten strong support through FMV's thorough requirement specifications."

Stringent inspections

As a link in the quality-mindedness within defence, the new encryption system will undergo, in addition to traditional encryption analysis, certification in accordance with the international code, Common Criteria. This means that the system will be inspected in regard to configuration, handling, development, functional specifications, design, source codes, user manuals, tests, vulnerability and support systems throughout the product's lifecycle. Every aspect of the formulation of the new encryption device will be documented and illustrated, including those people who participate in the process. In regard to encryption, nothing can be left to chance.

The encryption device, 920 is not only being developed for the Swedish Armed Forces. In FMV's assignment, it is included that the system shall also be adaptable to other authorities with high demands for security protection. This is welcomed by Jens Bohlin, who is an IT security specialist in the Swedish Ministry for Foreign Affairs.

"The ongoing expansion of EU's communication network between member countries places increasingly higher demands on security," he states. The Swedish Armed Forces' investment in new IP-encryption, which can also be used for EU-communication, will strongly support Sweden's possibilities to take a more active part in EU security work.

Battle Group

The encryption device, 920, will get its first baptism of fire in connection with the introduction of EU's joint military group, the Nordic Battle Group. On January 1, 2008 the group will be ready for action and, in addition, Sweden will have supplied the group with a secure management system with encrypted communication.

Over the long-term, there are plans to also integrate encryption connections for individual soldiers. A joint, fit-for-use encryption system is already on the drawing board and is intended for use by, for example, the Markus soldier project (soldier of the future).

COPY: JERRY LINDBERGH
PHOTO: BUSINESS SECURITY

WHAT IS ENCRYPTION?

Traditionally, encryption has been a way to keep information secret – to code messages so that unauthorized personnel cannot read them. The recipient must know what method is used for encryption and possibly the secret key to decipher the message. In today's IT society, however, it is not enough to be able to keep information secret, you must also ensure that no one has altered the information that is sent. This is called integrity control. Even if the message is encrypted so that no one can read it, someone who can access the message can change its content before it is sent further. Consequently, both encryption (read protection) and integrity security (write protection) are important. Origin controls are also important. This is so that you know that the message really does originate from the stated sender.

All encryption is done with the help of a code, which is an algorithm (method) that uses plain language, and a key to generate a coded text. Today's codes use keys that have 128, 196 or 256-bit keys. With a 256-bit key there are approximately 10,000,000 (+ an additional 70 zeros) different keys to test, which is almost as many as the presumed number of electrons in the universe.

Integrity control is solved with the help of a so-called hash sum. This is a method to generate a fixed number of bits that are associated to the message from the message itself. This is then used together with encryption to generate write protection. Origin controls require a little more. Normally it involves the use of a certificate to prove who you are. The certificate must be issued by someone that both parties trust, such as a Certification Authority.

Military, diplomatic and other critical security communications systems demand advanced and very well organized systems for encryption. Here, it is not enough to protect against unauthorized listening and unchecked changes. The information must be able to be kept secret for a long period of time, often several decades. Information that is assessed to have more long-term value is monitored and saved on a routine basis. Even after it has lost its actual news value, it can, in certain cases, be used as an aid in decoding other messages.

European support

Meteor is the first project within the 6-nation cooperation. And in the development of this ”European air-to-air missile” the Swedish fighter plane, Gripen, plays an essential role.

The Meteor project sticks out as the first within the unique 6-nation cooperation. The comprehensive project is now in the development phase. The radar air-to-air missile is a “Beyond Visual Range Air to Air Missile”. This means that the missile can be fired towards a target that is more than 100 kilometres away.

In general, in international co-operation, the road to requirement harmonization can be a long one.

“But that is a problem we have to accept,” says Peder Warreby, sub-project manager for FMV’s Meteor project, who points out that there is a totally different type of pressure put on a supplier if several countries are placing joint requirements on a particular product.

”With Meteor, the six participating countries get a European air-to-air missile that can be developed in a more cost-efficient manner. They are the ones who make decisions regarding the development, which would have been difficult if they had chosen to purchase a finished product,” he says.

Gripen

Meteor will be integrated with the JAS 39, Gripen, which will therefore play an important role in testing the missile.

FMV’s role in Meteor distinguishes itself from the authority’s traditional projects. The participating six nations have a joint contract counterparty and supplier with separate project offices at British DPA (Defence Procurement Agency) in Abbey Wood outside Bristol.

From the beginning, the project was a British initiative, but development costs proved to be too high and several nations were invited to participate. After FMV had studied the British project, it was proposed in 1995 that Sweden should participate.

The objective is mass production after the year 2010. In addition to the fighter, Gripen, Meteor is also intended to be used by Eurofighter and Rafale.

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ILLUSTR: GRIPEN INTERNATIONAL

6-NATION COOPERATION

The participating countries are France, Germany, Great Britain, Italy, Spain and Sweden. Since 2000 there has been a general standard agreement regarding defence materiel cooperation. Through the Meteor project, for the first time, all six countries will participate in defence materiel cooperation using the standard agreement as a basis.

Brothers in Arms

Swedish SEP and English FRES are two project groups in harmony. Early on there was an almost joint requirement specification. A Swede in Bristol is the connecting link.

Phil Reilly, DPA.

Anders Gustafsson, FMV

Anders Gustafsson from FMV works with the next generation of combat vehicles in the so-called SEP-project (Splinter fragmentation protection unit platform). As a special representative of SEP he is a vital link between the project groups at FMV and the English organization DPA’s equivalent in the FRES-project – Future Rapid Effect System.

Weekly basis

One week every month Anders resides at DPA in order to participate in the monthly meetings that are held between DPA and other involved parties in the project. So far the cooperation has involved the exchange of information.

”In the daily operations it is better with direct contact by having me on-site. Then I take the information home to Sweden. It works well. There is a great deal of openness from both sides,” says Anders.

In addition to the technical information exchange, FMV also gets concrete examples from the combat field.

“The feedback that DPA gets from its British forces in Iraq goes directly into the system as requirements on their materiel,” says Anders.

Like many other nations, Great Britain has the troublesome legacy of combat vehicles that lack the manoeuvrability and flexibility that is required for the future.

“The expiration date for our combat vehicles has more than passed,” says Phil Reilly, project leader for British FRES.

”Sweden is approximately one year ahead of us in development so we have a genuine interest in SEP,” says Phil, who also points out in the same breath that there are also other nations that are possible cooperative partners.

With today’s rapid, advanced technical developments, less mass-production orders and short lifetimes, it is hard to justify totally private development. That is why comprehensive work was done at an early stage in both projects to harmonize the requirement specifications prior to a joint development phase. FMV’s experiences from SEP and FRES go a long way, but the British study involves vehicle variants with heavier armament and varied roles.

“The main question for us is whether we, based on SEP, can further develop the other modules that Great Britain requires, for example the modules with direct fire weapons,” says Phil.

Network based

One of the major risks with the FRES-projects is calculating how to get the various sub-systems to function in a network-based defence. The FRES-group has an individual project management team that will tie together and coordinate the more than 100 sub-systems that shall communicate with each other.

FMV has already developed a prototype for such a system. The digital vehicle electronics system, Vetec (Vetronic Architecture Integration Project), was tested in SEP-driving rigs already at the end of 2003.

Swedish SEP vehicles.

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PHOTO: MAGNUS FORSBERG

FACTS

Swedish SEP

SEP (the splinter fragmentation protection platform) currently has twelve prioritised roles – primarily troop transport, medical transport, management and repair/salvage.

The combat vehicle will predominantly be adapted to a network-based defence. FMV studied both tracked and wheeled versions of SEP. In comparison to today’s combat vehicles, SEP will have an electronic transmission. With a combat weight of approximately 17 tons, it will be possible to rapidly deploy units using the transport plane, Hercules (C-130).

There are approximately ten people in the project group that have SEP as their main assignment. The project as a whole involves around 30 people.

British FRES

FRES (future rapid effect system) is, like SEP, a project for a mid-weight, network-based combat vehicle family. 16 different roles are being studied, among them, heavy armament with a direct firing cannon, air-to-air missiles and rocket artillery. The British project group has shown major interest for the tracked versions. FRES can be transported by aircraft.

The acquisition cost is expected to be SEK 190 billion with delivery after 2010. The total current need is 3,700 combat vehicles. Approximately 30 people are involved in the FRES-project.

PROTEC REWIND

MIC/HAEL MORIARTY/US NAVY

Gotland eludes US Navy

Despite an enormous capacity in naval firepower, there is one weapon platform that the American Navy cannot get a handle on – a Swedish submarine.

HMS Gotland during training in the Pacific. Shown in the background is the aircraft carrier, USS Ronald Reagan.

On July 18, 2005, the Swedish submarine, HMS Gotland, cast off from the dock at Point Loma in San Diego and headed out into the Pacific for its first training exercise on the American west coast.

”The initial exercises were done so that the Gotland and its crew could become acclimated to the Pacific Ocean, get the organisation to function and also let the Americans get a taste of the Gotland with various sensors,” says Navy Captain, Peter Östbring, contingent chief for the two crews that work at the submarine base at Point Loma, San Diego.

The mutual agreement (MoU) that the Swedish Armed Forces has with the US Navy means that HMS Gotland will operate from its new homeport for one year, with an option for an additional two years.

Near the coast

It is the Swedish Navy’s speciality, in other words, operating near the coast and in tight channels, that interests the US Navy. The Baltic Sea, with its average depth of 50 meters, is a natural environment for Swedish submarine crews who use the sea floor terrain as cover.

Up through October 2005, the Gotland had been able to spend 40 training days at sea and carried out a series of exercises with submarine chase helicopters and also the aircraft carriers, USS Abraham Lincoln strike group and the USS Ronald Reagan strike group.

”Things are moving, things are going well, but who is surprised?” says Peter Östbring via telephone in October.

“They are impressed with our Swedish technology, which makes us difficult to find. This is a competent little machine that we are sailing around in. She is just as good as we knew she would be back home,” he says.

The submarine as a weapon platform was previously, primarily intended for maintaining territorial integrity and hunting other submarines. But since the fall of the Berlin wall, conditions have changed. Today, the Swedish submarine is used for surveillance, intelligence and for monitoring sea traffic. With the submarine’s reconnaissance resources, a submarine can ”see” quite a bit on land.

“The submarine is one of the few weapon systems that can be active in an area for a long period of time without being threatened or discovered. This is especially important in the initial stage of an operation,” says Anders Järn, who is chief for the 1st Submarine fleet in Karlskrona.

In addition, it can be used for landing special units. Currently, the American Navy is refitting four submarines of the Ohio class to be used for operations with special units, something that the Swedish Armed Forces has recently done with the two submarines, Södermanland and Östergötland.

The essence of a submarine is its ability to remain hidden. Salt content, temperature, and flows create hydro-acoustic layers in the water that the submarine can utilize. Swedish submarines are known for being extremely quiet and can conceal themselves both magnetically and acoustically.

”But the crew that will man her must be effective. The least little mistake can spoil everything. And that can be devastating,” says Anders Järn.

Compared to the Baltic, the Pacific is full of life. The ocean floor topography, flows, salt content, biological environment and sea traffic are several factors that the submarine crew must take into account.

”Above all, there are a totally different variety of sounds, with whales and dolphins communicating with each other and with us. Also, it is quite deep. Sometimes we have a bottom of 2-3 kilometres,” says Peter Östbring.

HMS GOTLAND

HMS Gotland has been very difficult for American forces to locate. Here, an American cruiser is “on the prowl”.

MAGNUS FORSBERG

HMS Gotland’s discharge pipe. Modification of the submarine included the replacement of drainpipes to a quality that withstands warm, salt water. Parts of the seawater bearing system are, however, still adapted to the colder waters of the Baltic Sea. That is why vents, pipes and pumps are thoroughly checked.

MAGNUS FORSBERG

In June 2005 the HMS Gotland arrived at San Diego by cargo ship. In the background we see central San Diego.

Due to the great depth in the exercise area outside San Diego, the Gotland cannot use the bottom contours as cover. Instead, the crew must select the right attitude angle towards an active seeking sensor. Another method is to hide in the temperature layer that arises from tidal flows.

”It is a different environment compared with the Baltic Sea. But the water temperature and salt content are very similar to the water on the Swedish west coast,” says Anders Järn.

Salt water

Even if it is a pleasant climate for the two submarine crews, it is bad for HMS Gotland. The warm water of the Pacific and higher salt content are pure acid for tubes and valves. But functions and maintenance has worked well in the opinion of Peter Östbring. Before departure, a six-year overhaul was carried out where different systems were replaced or modified. This meant that the majority of materials, as well as the need for cooling capacity were adapted to temperatures and salt contents in tropical climates.

The submarine was also equipped with a new type of analysis equipment for active sonar sending and a new periscope with darkness capacity, infrared camera and an image magnification function.

The same equipment is planned to be installed on the other Swedish submarines.

Electricity

On the dock at the submarine base in Point Loma is the Navy’s only electrical power container, which was developed for international assignments in cases where the submarine’s homeport lacks infrastructure. The power container’s six-cylinder diesel supplies the submarine with power that is used to recharge the batteries.

”This makes us self-sufficient, and with the tool container for Stirling machinery we can manage for quite a while,” says Roger Bengtsson who is 2nd machinist on HMS Gotland.

Increased operation

In Sweden, operating time is approximately 80 to 100 sea days per year. In the US, this is increased to approximately 160 days. The last time the Swedish submarine fleet had such a large operations schedule was during the submarine hunts of the 1980s and 1990s.

“Initially we will have a larger operations period. We are monitoring monthly and quarterly maintenance, especially for the seawater bearing systems such as the cooling system, torpedoes and the ballast tanks,” says Anders Järn.

Even if the submarine functions well, there is a lot of distance between America and Swedish dock competence.

”The time difference is a major factor. When we start working in San Diego, people in Sweden are already on their way home,” says Peter Östbring.

On the other hand, there is relatively a small amount of maintenance on a submarine. The equipment is mounted where it is mounted and is not exposed to major structural stress. There are few rotating systems; only the diesel motors and the submarine’s propulsion system, the propeller engine.

Reinforcements

Prior to the overhaul period and docking, the land group is reinforced with additional technicians that are flown in from Sweden. The purpose is to inspect all seawater bearing cooling systems to see if the higher salt content in the water has affected the material.

It is apparent that the training exchange with the US is of benefit to the Swedish submarine fleet. And from FMV’s viewpoint it provides invaluable feedback regarding both maintenance and solutions for EU-registered units.

”It is a challenge for FMV to manage the maintenance and security clearance, but also beneficial prior to international assignments,” says Bo Wallander who is the naval attaché to the embassy in Washington.

“It is also important to promote the Swedish concept where FMV, the Swedish Armed Forces and industry have such close cooperation; the fact that with a small amount of resources we can do

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MAGNUS FORSBERG

WHY THE GOTLAND IS IN THE US

Before, the major powers planned for sea battles to be fought on the large oceans, but today’s peacekeeping efforts are often carried out near the coast or on land. And the closer you get to land, the larger the difficulties. It is difficult to carry out submarine chases in shallow water.

In the Baltic, conditions can change from hour to hour. That is why Swedish abilities using seapower forces near the coasts and with a possibility for amphibious operations have aroused major international interest.

The American navy had the opportunity for joint exercises against Swedish submarines as early as 2000, in the Mediterranean Sea.

“That was when they noticed that there was an opponent that they couldn’t really get a handle on,” says Lars Gunnarsson at FMV.

Since then, the navy has carried out repeated exercises with the American navy, primarily in exercises pitting submarine against submarine.

”Through that we made their submarine people realize that we know how to ”drive a submarine”. They have gotten to know our abilities, our naval ”thinking” with performances near the coast and in shallow channels,” says Anders Järn, chief for the 1st submarine fleet in Karlskrona.

The fact that the HMS Gotland is today carrying out training exercises in the Pacific began with a letter that arrived on the desk of the Swedish commander-in-chief, Håkan Syrén, in September 2004. The American naval commander, Admiral Vern Clark, expressed a desire that the US Navy, under an extended period, should engage in joint training exercises with a Swedish submarine.

It was only a short time after the letter arrived to the commander before the work with joint operations was underway. Submarines in the west would mean long maintenance channels. How will spare parts be delivered? How is a network in a ”friendly port” built up? How will personnel be rotated?

In March 2005 the Swedish government made a decision to allow HMS Gotland, together with two crews, to perform training exercises with the US Navy’s third fleet, based in San Diego, California for a period of one year. On May 13, Gotland left Sweden.

The US is measuring the Swedish competence in dollars. They are paying USD 17.5 million for the added cost that the training exercises in the west will create for the operation of the submarine, including maintenance, travel and personnel costs.

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PHOTO: KOCKUMS

FIGHTING LOOPHOLES

Vulnerability in society's information systems is a fact. Previously it was individual hackers who perpetrated the attacks; now organized crime has taken a step into the world of IT.

We basically hear about it every day. Infringements in commercial systems for Internet services, technological espionage or comprehensive hacker attacks via manipulated home computers.

In order for the future society, based on information technology to function, it is required that all who use the system can trust that the security characteristics, which have been promised also function in reality. Quite simply, this is about trust; knowing that the system is not vulnerable to different types of attacks.

Assurance

Assurance is the technical term for the measure of this trust. The problem is that there are not many organizations that have the resources or competence to assess security in those products they intend to use. Joint actions are needed; action, which initially aims toward reducing the likelihood of there being weaknesses that someone can utilize in separate technical solutions.

To achieve this, a method for inspecting the security of a product or a system is needed. The so-called vulnerability- security survey suggested that Sweden build a system for evaluating and certifying IT-security in products and systems. The Swedish government decided to give FMV the assignment of establishing such an operation based on the international agreement, Common Criteria Recognition Arrangement, CCRA.

The certification authority for IT-security, CSEC, is the name of the operating group within FMV that is carrying out the assignment. The assignments for CSEC include licensing the companies that evaluate the products, the so-called evaluation companies, and also educating them and providing them with support. They shall also review reports that the evaluation companies write in connection with the evaluation of IT-security products and also issue certificates.

Dag Ströman is operations manager at CSEC. As a comparison, he uses the airline industry to illustrate the need for joint methods.

"In view of the great number of flight hours that are produced internationally there are remarkably few incidents that occur and this is due to the fact that people work in a similar way and convey the mistakes they have made and their experiences so that the joint knowledge becomes substantially greater than that of the individual organizations.

Since the operation was started, work within CSEC has been about defining a certification plan and creating a quality assurance system so that the operation can be accredited by SWEDAC (Swedish Board for Accreditation and Conformity Assessment), which is the authority that tests the competency of certification agencies in Sweden. This is a step towards international recognition of the operation.

"Our focus is to become accredited by SWEDAC during the first six months of 2006, so that we can later initiate the process of being internationally reviewed and recognized during the third quarter of 2006," says Dag.

Before this, the CSEC must have carried out at least two test certifications, which can form the basis for both accreditation and the international review.

Objectivity

An important prerequisite for the certification program being accredited is its objectivity and impartiality not being able to be called into question. This also applies in such cases when production within FMV could have interest in the result of a certification, for example, by having ordered a certification. The solution has been that the management of CSEC is carried out outside FMV's ordinary operative management. FMV's Deputy Director General, Jan-Olof Lind, is directly responsible for the certification agency. He is the agency's representative in the FMV management and reports to the board.

COPY: HANS IVANSSON
PHOTO: JERRY

Common Criteria

– The standard that localizes loopholes

Common Criteria is a standard for defining requirements for IT-security in products from a buyer and seller's perspective. It also contains regulations and methods for carrying out independent inspections of IT-products in regard to security profiles and security objectives.

Purchasers and suppliers must develop their requirements themselves and state their demands in accordance with CC regulations. CC itself does not place any requirements on what security functions must exist for a particular product, or how thoroughly it must be inspected.

CC gives suppliers the possibility to state their product's security functions and how these are to be inspected in a document that is called "security objectives".

An evaluation company reviews and determines whether a supplier's demands on a product (stated in the security objectives) are realistic. In reviewing the conformity between the product and the security objectives the evaluation company uses a selection of methods:

*Analysis of processes and procedures in the development of the product.

*Inspections to see that the processes and procedures are used.

*Analysis of the design document against the requirements stated in the security objectives.

*Analysis of the conformity between the various abstraction levels in the design documentation.

*Verification of the conformity between low-level design and implementation (for example source codes).

*Verification of mathematical proof (for example encryption).

*Analysis of user documentation.

*Analysis of functional tests and test results that were carried out by the supplier.

*Independent functional tests, carried out by the evaluation company.

*Vulnerability analysis.

*Penetration test.

Which of the stated methods that are used for review of a specific product is defined by the indication of a so-called assurance level in the security objectives. There are seven assurance levels, where EAL 1 is the lowest and EAL 7 is the highest. From level EAL 5 demands are placed on how the product is designed and finally, level EAL 7 also includes demands for formal proof that the product was produced according to specifications.

"Through assurance levels the players are given a tool to balance the needs for trust in the products with the costs for carrying out an evaluation. The selected assurance level can depend on many factors," indicates Dag Ströman at the Swedish certification agency for IT-security, CSEC. These may be the protective value of access, the current operating environment, current threat status, available budget and willingness to take risks.

For the majority of products, an evaluation at level EAL 1 involves a limited cost, but still provides major value for the system owner. A certification in accordance with EAL 1 clearly states under what conditions the supplier considers that the product can be used securely and that the product has undergone fundamental testing. An evaluation at EAL 4 naturally involves greater cost as this also includes the analysis of the design documentation and source codes. For a complex product, such an evaluation can cost millions of Swedish kronor.

"However, this should be placed in relation to the product's development costs," emphasizes Dag. "Assume that you invest SEK 50 million to develop a complex IT product and that it will handle assets that can be worth many times more. In that case, it is definitely not the right decision to save ten percent of the development costs by not evaluating the product's IT-security functions."

EUROFIGHTER CHOSE FMV

”When you carry out flight tests you always look for extremes; and here is one,” says Chris Worning, the pilot who has winter-tested the European fighter plane, Euro-fighter Typhoon, in cold and snow at FMV’s test site in Vidsel.

The base in Vidsel is FMV’s northernmost test site. It is located near the Pite River, approximately 1,000 kilometres north of Stockholm. During three months, from the beginning of December 2004 to the beginning of March 2005, a lot of Spanish and a great deal of English were spoken here. A thirty-person strong team from EADS/CASA and the Spanish air force had come to FMV in Vidsel. In Swedish territory and Swedish airspace they tested the European fighter, Eurofighter Typhoon, in a winter climate.

”Our goal is to test in the cold, in temperatures of between minus 25 and minus 31 degrees Celsius,” says Javier Montesinos, EADS’s leader for flight tests. “We carry out tests to verify that our planes function correctly even under these climate conditions, both on the ground and during flight activities.

The team found Vidsel in 2003 when they were looking for a suitable place for their cold and winter tests. Kiruna in Sweden, Eielson in Alaska, and Bodö in Norway were Vidsel’s competitors. Eventually it came down to Eielson and Vidsel.

”In the end, Vidsel was a better choice for everyone involved,” says Javier Montesinos.

There were several determining factors. The distance from the European continent was one. The support that the Vidsel base is providing was another.

”This is a good test facility. The logistics are better here and we get the support we need from the test facility,” states Javier.

”The facility in Alaska is an airbase. Vidsel is a test facility. That is a major advantage,” says Manuel Silva, prototype manager for the tests in Vidsel.

Chris Worning, test pilot from EADS in Germany, adds:

“Yes, it is better to be at a test site than to be at a normal airbase. Here, we have the place to ourselves. At an airbase we would have had to coordinate things with two squadrons who operate in the airspace every day.”

Winter tests

The Eurofighter team's tests have been made during flights, on take-off and landing runways and while stationary on the ground. The purpose has been to control that the aircraft also functions in cold and a winter climate. The tests have dealt with the adaptation of landing gear and also the development of the aircraft's electrical system and control system and a lot, lot more.

"We do the same things here that we do when we do tests at other locations. We test the aircraft as much as we can," says Chris Worning.

However, the weapons system was something that had never been tested during the winter months in Vidsel.

Everything is registered

When Chris Worning or Eduardo Cuadraro, the second of the two test pilots who were at the test site during PROTEC's visit, tests fly the Euro-fighter, everything that occurs in the plane is registered. Sensors and other measurement equipment collect data that is immediately sent from the plane in the air to a control station on the ground.

That is where the technicians are located who monitor and register the data and draw conclusions from it.

"Here, we can measure and see movements in the aircraft's fuselage. We see temperature differences, how the engines work, what the pilot is doing and more," says José Ignacio Nieto.

He sits in the control station, a mobile facility filled with computers, monitors and various control panels. The station that has been brought from Spain by EADS/CASA is parked in the hangar that the team will use during the test period. Via the Vidsel base's own telemetry facility approximately 10,000 different parameters from the Eurofighter are transferred to the control station.

"We have our own antenna to capture data from the aircraft, but we don't use it," says Manuel Silva. Instead we get data from the aircraft via the test site's telemetry facility since it is better and more secure than the equipment we have.

Private management

The Spanish team has carried out tests under private management but with support from those functions that are available at FMV's test site. The telemetry facility and telemetry technicians have already been mentioned. The weather service at the base has ensured that the Eurofighter team has received current weather data and forecasts. Ground personnel have kept the runways snow-free, or in accordance with conditions that the customer has requested.

Fire and rescue services have been on alert in case an accident should occur, air-traffic control has kept a check on airspace, and other test personnel have ensured that fuel was always available for the Eurofighter. In addition, security and guard personnel that are stationed at the test site have created conditions for the confidentiality that was requested.

Gripen hangar

The hangar that the Spanish team and the Eurofighter have utilized was originally constructed for the fighter plane, Gripen, and the tests of weapons systems that the Gripen project carried out in Vidsel.

The EADS/CASA-team has no problem in being in the building, which at the test-site is called the Gripen-hangar.

"No, why should we? Competitors? Not at all. The Eurofighter and Gripen are actually two totally different aircraft," says Manuel Silva and Javier Montesinos.

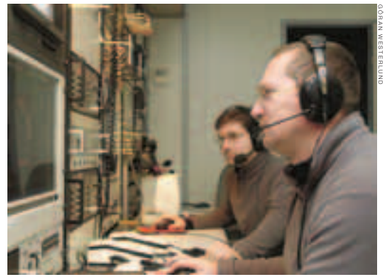
"We actually have a friendly dialogue with Saab. When we meet we exchange experiences, 'this is what we do, what do you do?'" says pilot Chris Worning who adds diplomatically:

"The Gripen is a good airplane.

When the cat's away… The so-called Gripen-hangar at FMV's test site in Vidsel has been used in winter by the Spanish air force and EADS/CASA and their Eurofighter, Typhoon.


GÖRAN WESTERLUND


ANDERS ÅBERG


GÖRAN WESTERLUND

LEFT Test pilots Eduardo Cuadraro and Chris Worning study northern Swedish aviation maps. At FMV's test site in Vidsel there is plenty of airspace.
MIDDLE The Spanish Eurofighter team got hooked on FMV's test site in Vidsel when the Euro-fighter, Typhoon, was tested in snow and cold conditions.
RIGHT Movements, temperature, speed… Data from the test flights are transferred to the EDAS/CASA control centre. José Ignacio Nieto (left) and Manuel Silva know what's going on with the Eurofighter.

Tender offer work

In his office in a building a few hundred meters from the Gripen hangar sits Ingemar Berglund. He is one of four assignment managers at FMV's test site in Vidsel. Ingemar is one of those persons who have seen to it that the Eurofighter team's desires regarding testing their aircraft at Vidsel have been realized. The tender that the Spanish air force and EADS/CASA developed ended up with Ingemar.

"My assignment is to formulate a package solution that functions on a practical, technical and economic level.

Ingemar finds out what the customer wants and what the test site has in regard to resources to meet these desires.

"What personnel time and what test system are needed? I have to make sure that the personnel and other requested resources are available. Based on the response I get, I make a time and activity plan and write an assignment plan. This describes how we expect to carry out the entire project; an offer to the customer, in other words.

The assignment plan is reviewed by an expert group. Then, a decision is made whether there is sufficient documentation for an offer. If that is the case, the offer is sent to the customer, who either orders the job or passes.

Cold

The Spanish team was looking for a sub-arctic climate. That was one of the fundamental criteria when they were looking for a test site. But Ingemar Berglund explains that it was not only snow and cold weather that made the Spanish team choose FMV's Vidsel site.

"No, it was also thanks to the fact that we can offer confidentiality and the desired security level. That, plus infrastructure, in other words, the premises and support we can provide, was beneficial to us. We have space here that is specially adapted to aircraft testing.

The test site in Vidsel has Western Europe's largest test area with airspace over land. The land area is 1,650 square kilometres and the available airspace is substantially larger.

Collectively, around 150 people work here. These consist partly of FMV's own personnel and partly of personnel from a security firm and other contractors.

Since the 1960s, foreign customers have been coming to Vidsel to carry out tests. But it was only a few years ago that the site was actively marketed internationally as a test site.

"Things have started to pick up now," says Nils Widén, FMV's site manager at Vidsel.

He states that capacity has been good the last few years.

"In 2005 we had the Italian company Alenia here to test an Unmanned Aerial Vehicle. Other elements were the Italian Army's firing of anti-aircraft missiles and the Belgian air force's testing and evaluation of night vision goggles.

It also looks like 2006 will be an intensive year up in barren Vidsel. For example, the Royal Marines from Great Britain will fire high velocity missiles, Holland will test night vision goggles, the Czech Republic will carry out firings on air targets with its Gripen plane, and the American manufacturer, Raytheon, will carry out AMRAAM missile firings in cooperation with six countries.

But why do these and other customers choose Vidsel?

"It is a unique test site. Our test area over land has no equivalent in this part of the world. We are also flexible and adapt ourselves to our customers' needs, says Nils Widén.

Attractive location

The Spanish Eurofighter team say that they have been happy with what they have gotten at Vidsel. However, it is too early to say whether or not there will be more Eurofighter visits at FMV.

"We don't know yet how things will be in the future; whether there will be more tests carried out in the cold," says Javier Montesinos.

But no one will be surprised if the Eurofighter shows up in the Vidsel area again. Test pilot Chris Worning says that the test site and test area will always remain attractive.

"When a large test area is needed, Vidsel will always be an attractive alternative. And when modern weapons are to be tested, large areas are definitely needed."

COPY: GÖRAN WESTERLUND
PHOTO: ANDERS ÅBERG

EUROFIGHTER vs GRIPEN

(Gripen within parentheses)

Length: 14.5 meters (14,1).
Wingspan: 10.5 meters (8).
Crew: 1 (1).
Cruising speed: 2,125 km/h (2,126).
Range: 1,135 km (3,000).
Number of engines: 2 (1).
Maximum load: 6,500 kg (6,000).

Source: www.flygtorget.se

EUROFIGHTER PROJECT

Germany, Great Britain, Spain and Italy are behind the Eurofighter project along with the companies, BAE Systems (Great Britain), EADS (Germany), EADS/CASA (Spain) and Alenia Aeronautica (Italy).
The project's roots go back to the 1970s when Great Britain, Germany and France wanted to create an aircraft that matched the desires of the three nations' air forces. This and other cooperative projects resulted in that Spain, Germany, Italy and Great Britain started the Eurofighter project in 1986. In March 1994 flights were conducted with the first prototypes.
In total, 620 Eurofighter Typhoons shall be delivered to the four nations, 180 to Germany, 121 to Italy, 87 to Spain and 232 to Great Britain. In addition, Austria has purchased 18 aircraft.

(EADS=European Aeronatic Defence and Space Company)

ACTIVE SONARS

On behalf of the Swedish Armed Forces, FMV is acquiring sonar systems for submarines of the Gotland and Södermanland class.

Having some form of sonar is elementary for a submarine. With the help of sonar a target and other ships can be localized. Sonar systems can be divided into two main groups: passive and active.

"In principle, passive systems consist only of a number of microphones," says FMV's project manager, Peter Timling. "But new submarines are becoming increasingly quieter so it is getting harder and harder to detect them with passive systems. With an active sonar system you send out a sound that bounces back off the target. In that way you get a much more secure understanding of the target's direction and speed. In addition you know the distance to the target."

Five frequencies

Today, the Swedish Armed Forces' submarines have a limited ability to seek out mobile targets and mines with the help of active sonar. The active systems that exist have only one frequency and a limited range.

In the active sonar systems that are being acquired, Subac (Submarine active sonar), there are five different frequencies that can be obtained. All are intended for different tasks and therefore provide different ranges and different degrees of resolution on the screens.

"In general you can say that a low frequency gives a longer range and that a high frequency makes is easier to discern details," says Carl Gerhardsson, who was project manager between 2002 and 2004, but who is now involved in the next generation sonar systems.

The five frequencies are divided into three sub-systems; mine warnings, anti submarine warfare and bottom navigation. Each system has its own sonar.

"Before the purchase, we chose to establish a detailed list with functions that the system should be able to handle. This was done in order to have the possibility to make updates in the future," says Carl. "But already now, in the first stage, our submarines will be able to handle a great deal more than they could do before."

Among the new functions that can be named is automatic target detection, which means that the computer can mark interesting objects and track them. In addition, the data is presented in 3D to a larger extent than before and the three sub-systems are integrated so that the operator can utilize all five frequencies and three subsystems from a single workplace.

In total, it will be an extremely outstanding system. Having all three sub-systems integrated in one submarine is unique.

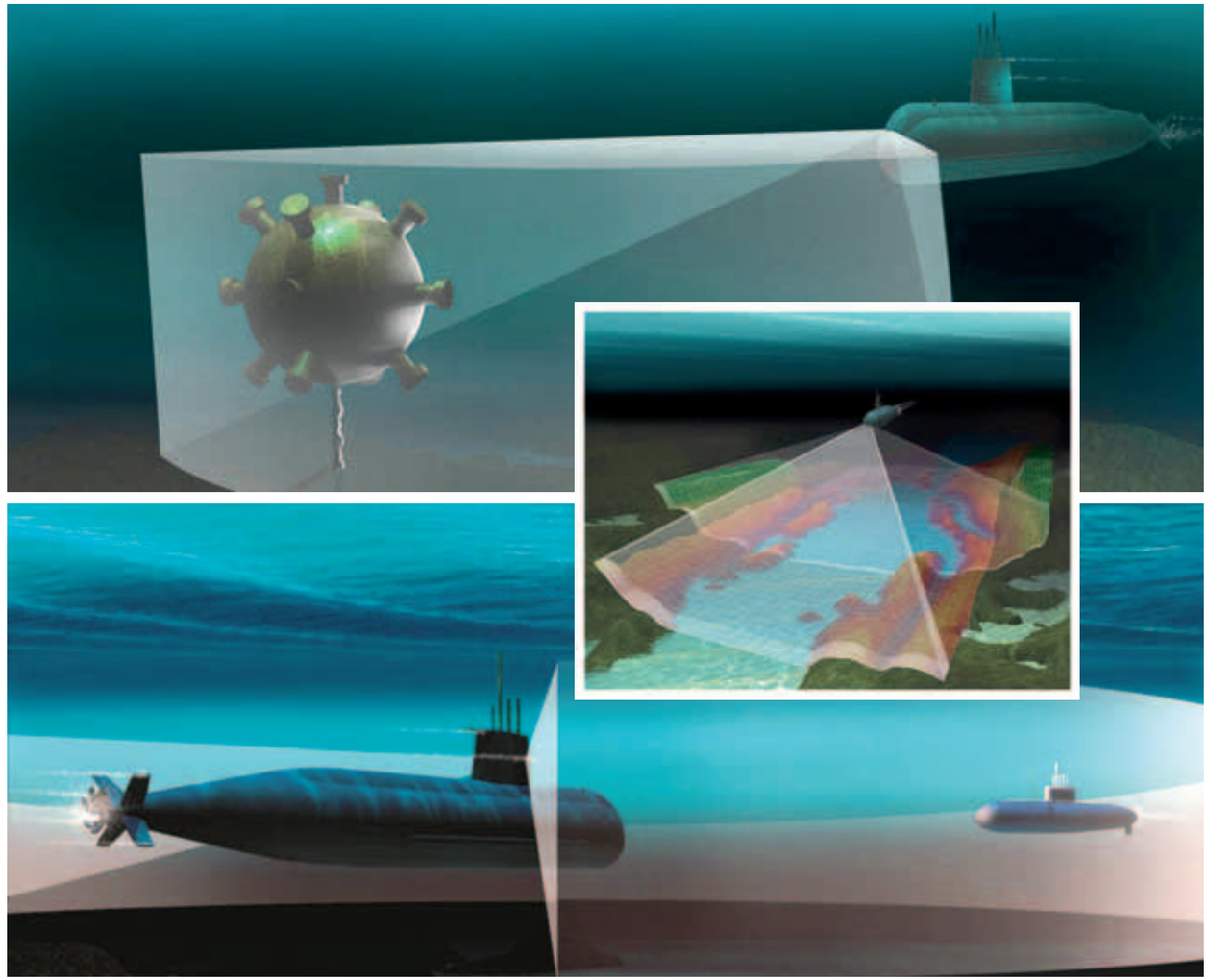
"We have many tasks to fulfil and we will solve them in the Baltic Sea and also in international waters," says Peter. "In extremely salt water the range of the signal is generally cut in half, but with our broad spectrum of frequencies we have a good chance to compensate for this by using the right frequency for the right task. The only thing that may be missing is an extremely low frequency to have a very long range in the Mediterranean Sea."

Construction phase

The project with Subac was started in 1999, but was forced to be shelved for several years due to a lack of personnel. Now, the critical design for the system has been completed and the construction phase is underway. The Subac-system is delivered by the Danish company, Reson, which has developed the system in accordance with FMV's requirements. The manufacturer's own tests in a laboratory environment are expected to start in the spring of 2006 and shortly thereafter it is also expected that the installation in the submarines can begin. The first system is expected to be installed in the latter part of 2006 when tests will be initiated at docks and at sea.

From 2008 all existing submarines will be equipped with Subac, ready for use both nationally and internationally. However, the fact that the new active sonar systems will be installed on the submarines does not mean that the existing, passive systems will be scrapped.

"No, if you send out a sound, it is highly likely that it will be heard by your enemy," explains Carl. "Therefore, in many situations it can be better to use a passive system and in that way stay undetected as long as possible. You have to balance in one's mind when it is the right time to 'ping'."



Sonars in the system

The Subac-system consists of three subsystems. All submarines in the Gotland and Södermanland class will be equipped with all three types of sonar – mine detection, anti submarine chase and bottom navigation.

Mine detecting sonar

This is located at the front of the submarine and is primarily used to detect mines. The sonar has two frequencies; one for the actual detection of the mine and one for a limited classification of it. Knowing that it is an actual mine that is in your path is of great importance, especially to avoid unnecessary manoeuvres around false mines when submarines are moving near the bottom and margins are small. That is why the mine detection sonar is also specially adapted for terrain navigation. The crew can then be given a good understanding of what the terrain looks like a couple hundred meters forward. This sonar can also be helpful for anti submarine warfare operations.

Bottom navigation sonar

This sonar has two frequencies and is pointed straight down, with a certain range to the sides. It is used for sea charting. The bottom is searched now and then and the information is used to create a map of the ocean floor. Another function is position updating of the submarine. Sonar information is compared with existing digital sea charts. In that way the crew can see exactly where the submarine is located. Otherwise, a submarine normally navigates based on a calculated position, which means that you calculate where you are by checking times, course and speed. Ultimately you have to surface in order to get a more exact positional description by GPS, which to a large extent can be avoided using this system.
The third and last function in the bottom navigation sonar is that you can photograph the bottom for intelligence purposes.

ASW sonar

The ASW (anti submarine warfare) sonar has a frequency for discovering mobile targets in the water and on the surface. The sonar can be sent omni-directionally, in other words, 360 degrees, or in a pre-determined sector. The frequency is considered low in the Baltic Sea, but considered a mid-range frequency in international waters. The signal is absorbed in salt water and therefore has a substantially shorter range.

Plans exist to integrate the new sonar system, Subac, in the new guidance system (Sesub 960) that will be installed in Swedish submarines within a few years. It will then be possible to send information between the sonar and the guidance system.

COPY: JERRY LINDBERGH
ILLUSTRATION: RESON

CARABAS RIDES OUT THE STORM

Trees felled by storms are identified with the help of radar technology developed by FOI (Swedish Defence Research Agency) and Ericsson Microwave System. FMV has been managing the project, Carabas, for the last four years.

Carabas is a new radar technology that does not exist yet in any other place in the world. It is based on low frequencies (20 - 90 MHz, VHF-band). The actual goal is to register objects that are hidden or are located in forests. Carabas has the ability to search large ground areas in a very short time. It is here that the identification of damages after the storm in southern Sweden comes into the picture. From a flying platform, reflexes were measured from ground surfaces and then it was possible to get a perception of the damages. Forest owners and insurance companies benefited greatly from this.

"The technology is very effective," says Lars Ulvesand, project manager at FMV. In principle, all of Sweden can be processed in 24 hours. The problem is that you get incredible amounts of objects to be registered. To keep the level of registered ground targets down, change detection is normally used. This is done wherein an area is registered by a flyover, and when you feel that something interesting has occurred you redo the process. With change detection, only those targets that have changed position are visible.

Carabas was started as a research assignment by the Swedish Armed Forces in 1985. The manufacturer, Ericsson Microwave, entered the picture in 1993 and FMV took over the management and administration of the project in 2001. In 2005, the project initiated cooperation with authorities and suppliers in Italy.

"We are contributing with Carabas and the Italian are contributing with short-frequency radar, which will make it possible to also identify mobile targets and to get better resolution," says Lars Ulvesand.

COPY: HANS IVANSSON
PHOTO: PETER LIANDER

STEALTH BOAT NUMBER FOUR

Now, yet another Swedish stealth boat is making waves. On August 18, 2005, the HMS Nyköping was launched – the fourth stealth boat in the Visby-series.

The launching ceremony at the Kockums dock in Karlskrona was, as usual, an event featuring well-known speakers. Kockums' Managing Director Martin Hagbyhn, Naval Inspector Anders Grenstad, and FMV's Director General Gunnar Holmgren, all pointed out that the Visby-series ship was something out of the ordinary. It forms the backbone of the future Swedish Navy and is world leading with its advanced stealth technology. The actual christening was done by parliament spokesman, Björn von Sydow.

HMS Nyköping is the fourth sister ship of the five in the Visby-series. The ship is now entering an intensive installation period. During the next year a great deal of electronic systems will be installed on the ship.

In total, the Swedish Armed Forces will acquire five stealth boats. The three previous ones are HMS Visby, HMS Helsingborg and HMS Härnösand. The fifth and final ship will be called HMS Karlstad. The ship is made of carbon-fibre-armed plastic laminate, which makes it very strong in relation to its weight. The non-magnetic hull, stealth-design and propulsion by a radiant energy operating unit are some of the secrets behind the ship's world leading stealth technology.

COPY: JERRY LINDBERGH
PHOTO: KOCKUMS

Flight safety inspector Tommy Pålsson gives authorisation certification to the operations manager and FMV's Deputy Director General Jan-Olof Lind.

FMV AUTHORIZED IN ACCORDANCE WITH RML

As of February 11, 2005, FMV has been authorized as a design organisation for air force products within system levels 2 and 3*. This means that FMV will be responsible for system development and configuration management for specific materiel systems and/or products.

During week 6, the Military Flight Inspection Agency (FLYGI) carried out a certification audit of FMV. Three auditing teams interviewed personnel in leading roles within product management and within competence management as well as within a number of selected materiel systems and projects. FMV could show an operational management system and an internal operation audit that more than meets the requirements of the Military Flight Inspection Agency. Personnel have shown good knowledge about the operational management system as well as the inherent tasks, responsibilities and authority of the various roles. In addition, the product managers have, in a confident way, reported on systems work, configuration management, system security and also operational monitoring within the respective materiel systems. However, the audit results also showed that FMV must take actions to obtain joint supervision of the design integrity of air force products within all external production.

This includes an independent internal review function and administration of changes. The action plan for this type of work has been presented and the Military Flight Inspection Agency has assessed that the actions, in accordance with the reported action plan, will provide the desired result. Therefore, authorisation was in effect as of February 11.

The authorisation is of great importance for flight safety work with the Swedish Armed Forces and also for export transactions regarding jet fighter Gripen.

To maintain authorisation, continued major demands are placed on FMV. The Military Flight Inspection Agency will carry out follow-up audits at least once a year.

COPY: EDDIE LINDQVIST
PHOTO: JERRY LINDBERG

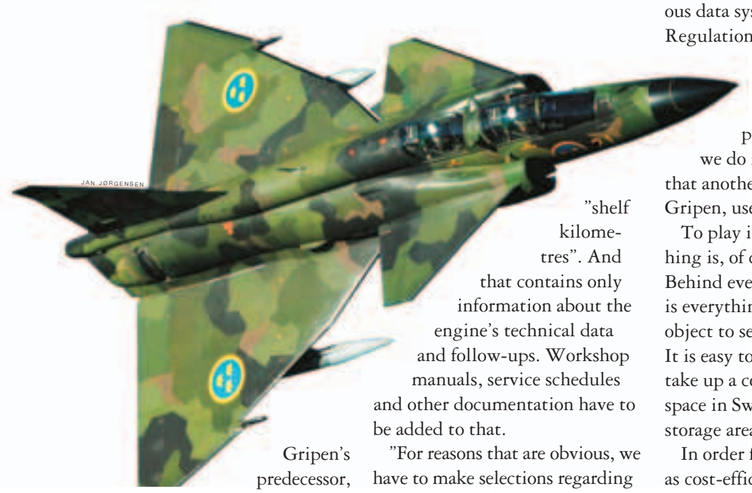
RML

RML – Regulations for Military Air Traffic.

* The System level 2 includes materiel systems. An example of a materiel system is the system JAS 39 Gripen, which includes the sub-systems (system level 3) of the actual aircraft, weapons/external cargo, support systems/training and pilot equipment. In this example, however, it is not FMV that has responsibility for all level-3 products. Product responsibility for the

LAST STOP

For several decades the Saab 37, Viggen, was the backbone of Swedish defence. That makes the phasing-out of the plane sombre work.


JAN JÖRGENSEN

Gripen's predecessor, the jet fighter Viggen, is retiring.

But phasing out a materiel system is nothing that can be done quickly. Documentation and spare parts must be handled in accordance with special regulations, and in Viggen' case, this involves a great deal.

"The Viggen system is, and will remain, the largest military project that was carried out in Sweden. In total it consists of 116,978 different article numbers," says Gunnar Jonsson, who is FMV's project manager of the Viggen system.

The documentation for the system is enormous. For example, every engine has generated ten shelf meters of documentation during its lifetime. In total there have been 375 Viggen engines, so the documentation concerning these is also almost equal to four "shelf kilometres". And that contains only information about the engine's technical data and follow-ups. Workshop manuals, service schedules and other documentation have to be added to that.

"For reasons that are obvious, we have to make selections regarding the archiving of Viggen documentation," says Gunnar. It is not only about engine documentation but also about documentation regarding the air force, armaments, software, source codes, etc.

Information about work groups and cooperation also has to be documented: why was a certain work group started? How was the work developed and what mistakes were made or what successes were achieved? That kind of information can be valuable in the future.

Complex

One of the most important tasks during the phase out is to ensure that those articles that are scrapped are not part of any military system that may still be in operation after December 31, 2005, when the last Viggen plane was taken out of operative service.

"Since the Viggen system has been built up and further developed since the 1960s, there are deficiencies in the information, which today is stored in the Swedish Armed Force's various data systems," says Gunnar. Regulations and procedures have changed greatly over all these years and that makes it complicated to ensure that we do not get rid of materials that another system, for example, Gripen, uses.

To play it safe and save everything is, of course, not possible. Behind every article number there is everything from an individual object to several thousand objects. It is easy to figure out that these take up a considerable amount of space in Swedish Armed Forces storage areas throughout Sweden.

In order for the phase out to be as cost-efficient as possible, a certain phasing out of Viggen parts was initiated in the early 1990s. Stocks have thereby gradually been reduced and great consideration has been taken in not purchasing spare parts unnecessarily. Instead, parts have been recycled from planes that have been scrapped over the years. When Viggen's last flight is done, all superfluous material will have already been destroyed or sold in accordance with those directives that the Swedish Armed Forces has established.

"The long-term phase out and recycling of parts from scrapped planes has meant a savings of at least SEK 500 million for the Swedish Armed Forces," states Gunnar.

Confidentiality

A portion of the material that is included in the Viggen system is classified top-secret. If the classification is changed during the phase out then FMV has to verify that the affected software or hardware is not included in any other system where the top-secret classification still applies.

Before the scrapping, the material will be risk and environment analysed in order not to result in risks for personal injuries, environmental or material damage.

"This is about identifying dangerous substances such as, for example, cadmium, asbestos and radioactive materials," says Gunnar. "It can also be about tension and suspension cables that can be dangerous when being disposed of. Neither people nor the environment shall be exposed to danger at the time of disposal or after."

The actual scrapping is handled by different recycling companies. The work is financed wherein the companies take care of all gold, silver and platinum alloys that are in the planes. In the event of a surplus, the profits are divided between the company and the Swedish Armed Forces.

Museum

All old Viggen planes will not be scrapped. A number will be sent to various flight museums throughout Europe.

But museum planes also require a certain amount of attention.

"All secret materials have to be removed and secret radio frequencies have to be erased," says Gunnar. "Gunpowder must be taken out of the canopy ejector, ejector seat and weapon pylons. In addition the engines have to be altered so they will not start, fuel has to be drained, the pressurization system unloaded, etc."

Last but not least it is important to check that no material disappears in connection with the phase out. That which is not saved has to be destroyed in the right manner. Many people want souvenirs from the plane, but nothing is allowed to be given away. For example, imagine that an altimeter was reused in a civilian plane, which crashed due to the altimeter being defective. Who would bear the blame?

Jet fighter Viggen has met its last opponent – the scrap crane at a recycling company.

COPY: JERRY LINDBERGH
PHOTO: STENA GOTTHARDS

Technology for Sweden's security

FMV